Update on Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane

Brookhaven Executive Roundtable
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BROOKHAVEN NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

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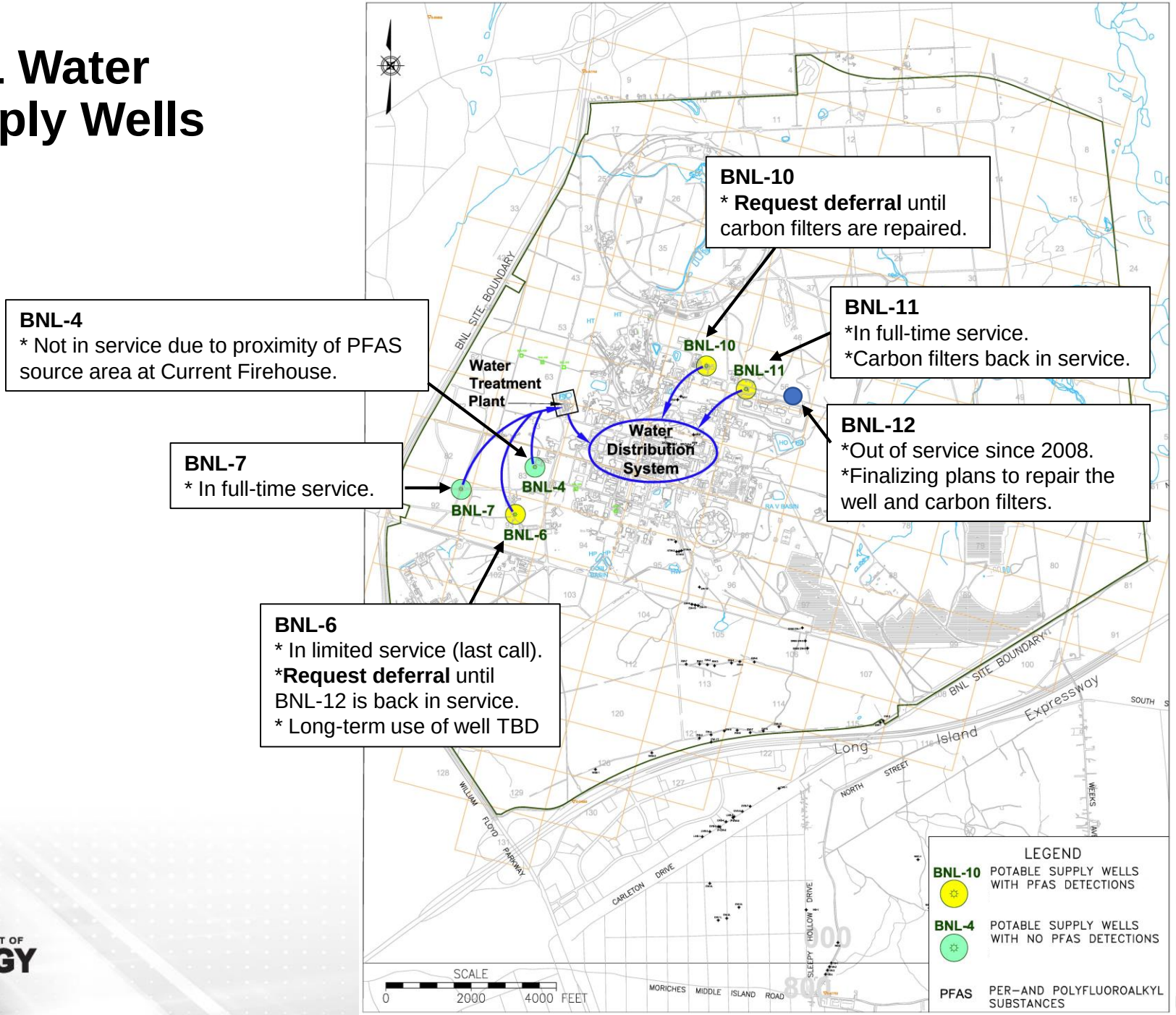
What are PFAS and 1,4-Dioxane?

- Per- and Polyfluoroalkyl Substances (PFAS) are a diverse group of chemicals first developed in the 1930s
  - Used in manufacturing many industrial and consumer products to make them resistant to heat, water and oil
  - “Class B” foam used for fighting hydrocarbon fires contained various formulations of PFAS. BNL started to use this type of foam in the 1960s
- 1,4-Dioxane is also found in many industrial and consumer products
  - Was used as a chemical stabilizer for degreasing solvents such as 1,1,1-Trichloroethane (TCA)
    - BNL has been remediating TCA contaminated groundwater since the 1980s
- BNL began to test for these chemicals in 2017
  - BNL’s current groundwater treatment systems cannot effectively remove 1,4-Dioxane. Treatment systems that use granular activated carbon filters are effective for PFAS

New Drinking Water Standards

- "Notice of Adoption" was published in the NYS Register on August 26:
  - 10 ng/L (parts per trillion) for Perfluorooctane sulfonate (PFOS)
  - 10 ng/L for Perfluorooctanoic acid (PFOA)
  - 1 µg/L (part per billion) for 1,4-Dioxane
- Medium sized water providers like BNL must start testing for these chemicals within 90 days
  - BNL has been sampling the supply wells for these chemicals on a quarterly basis since 2018
  - BNL has also been working to return to service carbon filters that will remove PFOS and PFOA
    - Filters at one well (BNL-11) are back in service
    - 1,4-Dioxane is not impacting the potable wells
    - BNL will apply for temporary "deferrals" from the new standards for two of the five active supply wells while the work on the carbon filters continues. BNL will limit the use of PFAS impacted wells as much as possible
- The new standards may require BNL to make changes to the ongoing groundwater remediation and monitoring programs
  - Awaiting guidance from the regulatory agencies

BNL Water Supply Wells



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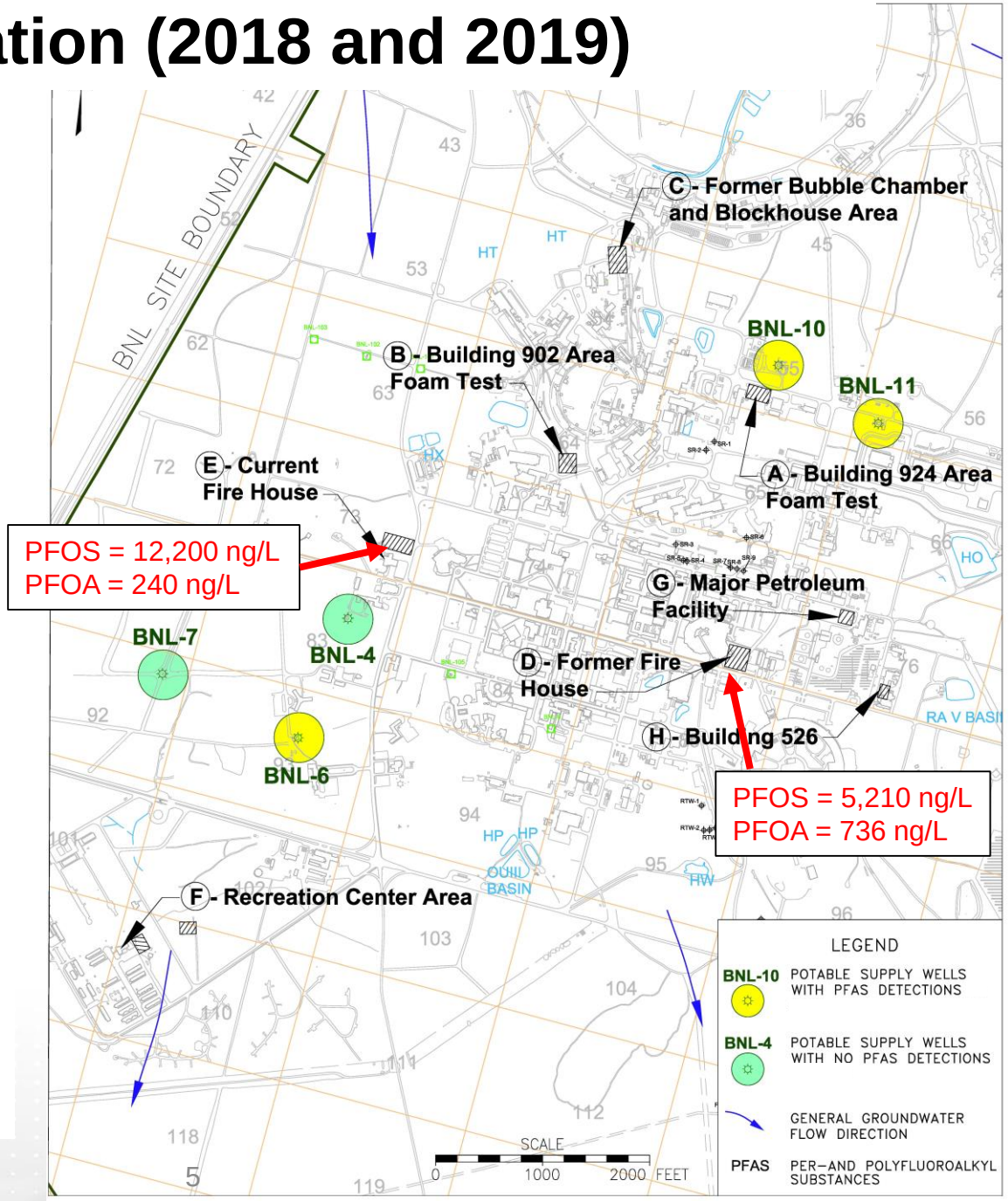
PFAS Characterization (2018 and 2019)

- PFAS are related to the use of firefighting foam (1966-2008)
- Eight foam use areas have been identified:
  - Firefighter training areas
  - Fire suppression systems testing
- PFAS were detected in groundwater at all eight areas
- Highest PFAS concentrations are associated with firefighter training areas located at:
  - Former firehouse (foam used from 1966 to 1985)
  - Current firehouse (foam used from 1986 to 2008)
- Also sampled wells near two landfills, Sewage Treatment Plant, and along BNL site boundary



PFAS and 1,4 Dioxane Characterization (2020)

Comprehensive sampling of 350 on-site and off-site monitoring wells and treatment systems for PFAS and 1,4-Dioxane

Detailed characterization of the current and former firehouse PFAS plumes

Sampling a permanent monitoring well

Sampling a temporary well

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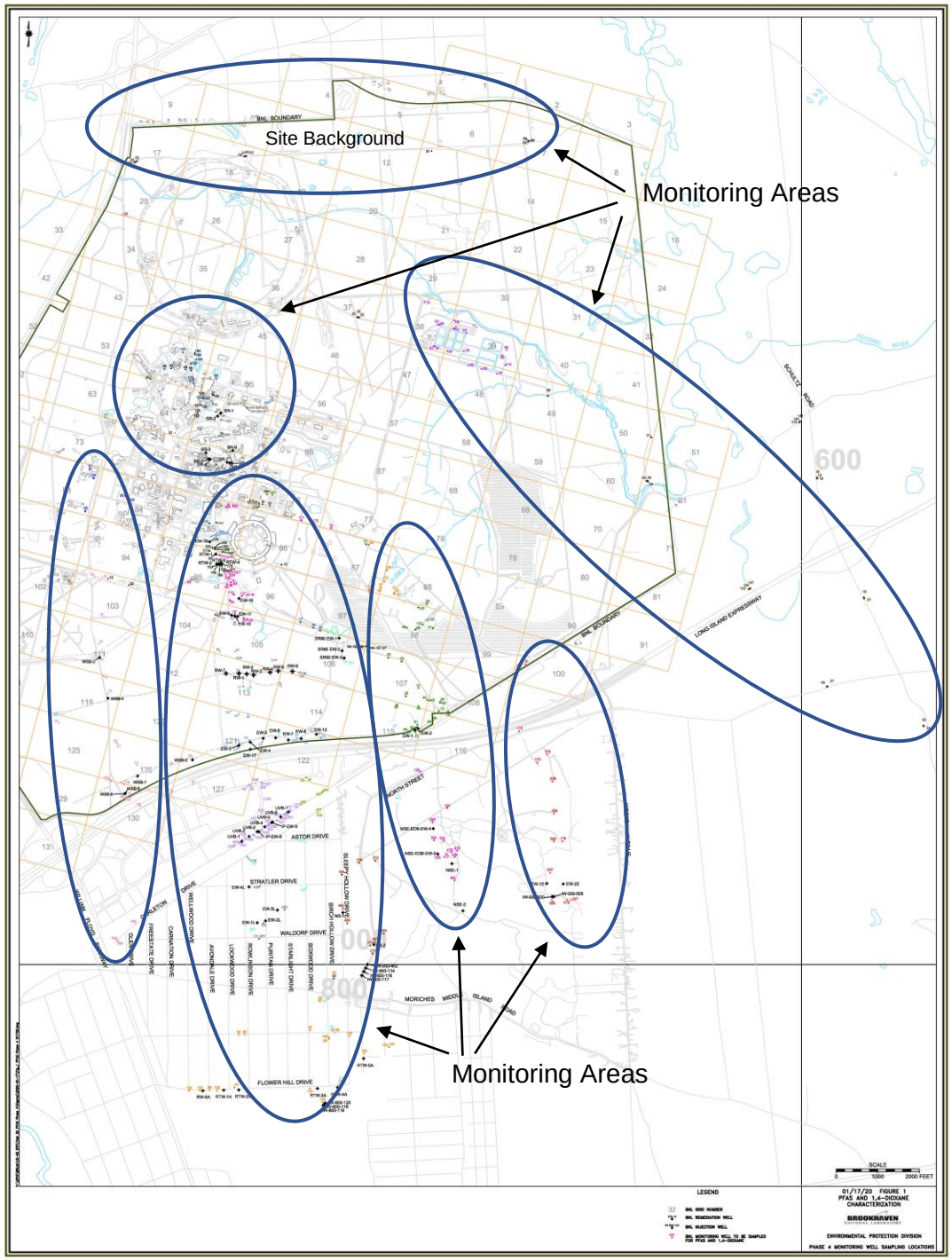
Comprehensive Characterization

- Conducted January - September 2020
- Collected samples for PFAS and 1,4-Dioxane at each location:
  - 350 on-site and off-site monitoring wells
  - 27 off-site extraction/treatment wells
  - Influent and effluent from 3 on-site and 5 off-site groundwater treatment systems



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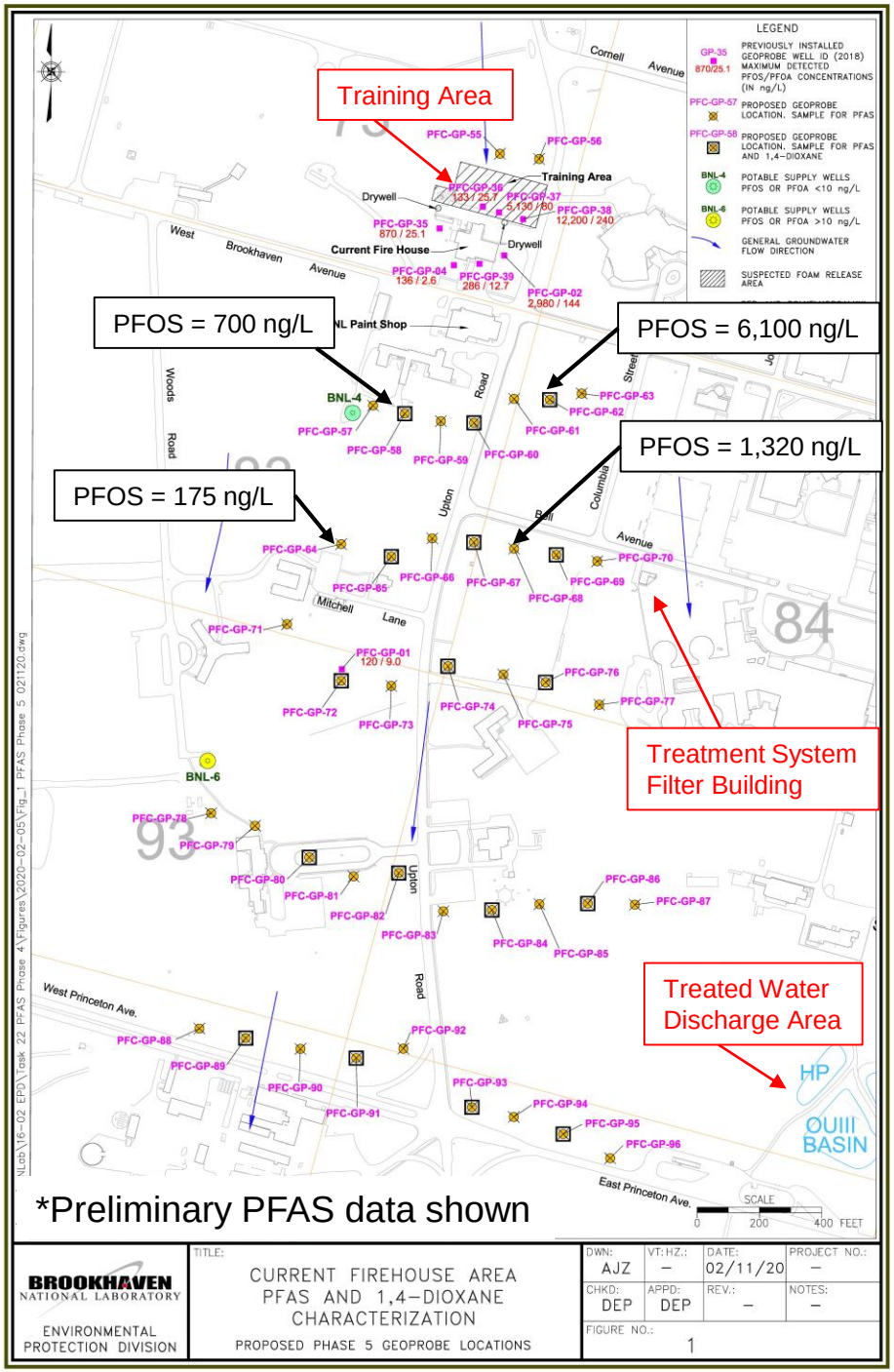
Remediation of Current and Former Firehouse PFAS Plumes

- DOE has provided $10.9M to install remediation systems for the high concentration plume segments associated with the firehouse source areas
  - Detailed characterization of the plumes started in July 2020. Expect to complete by mid-October
  - BNL is working on the conceptual design for the treatment systems
    - Contaminated groundwater will be pumped out of the ground using a series of extraction wells
    - Water will be treated using granular activated carbon and/or ion exchange resin filter systems
    - Plan to reuse infrastructure for several inactive treatment systems. Will result in significant time and cost savings

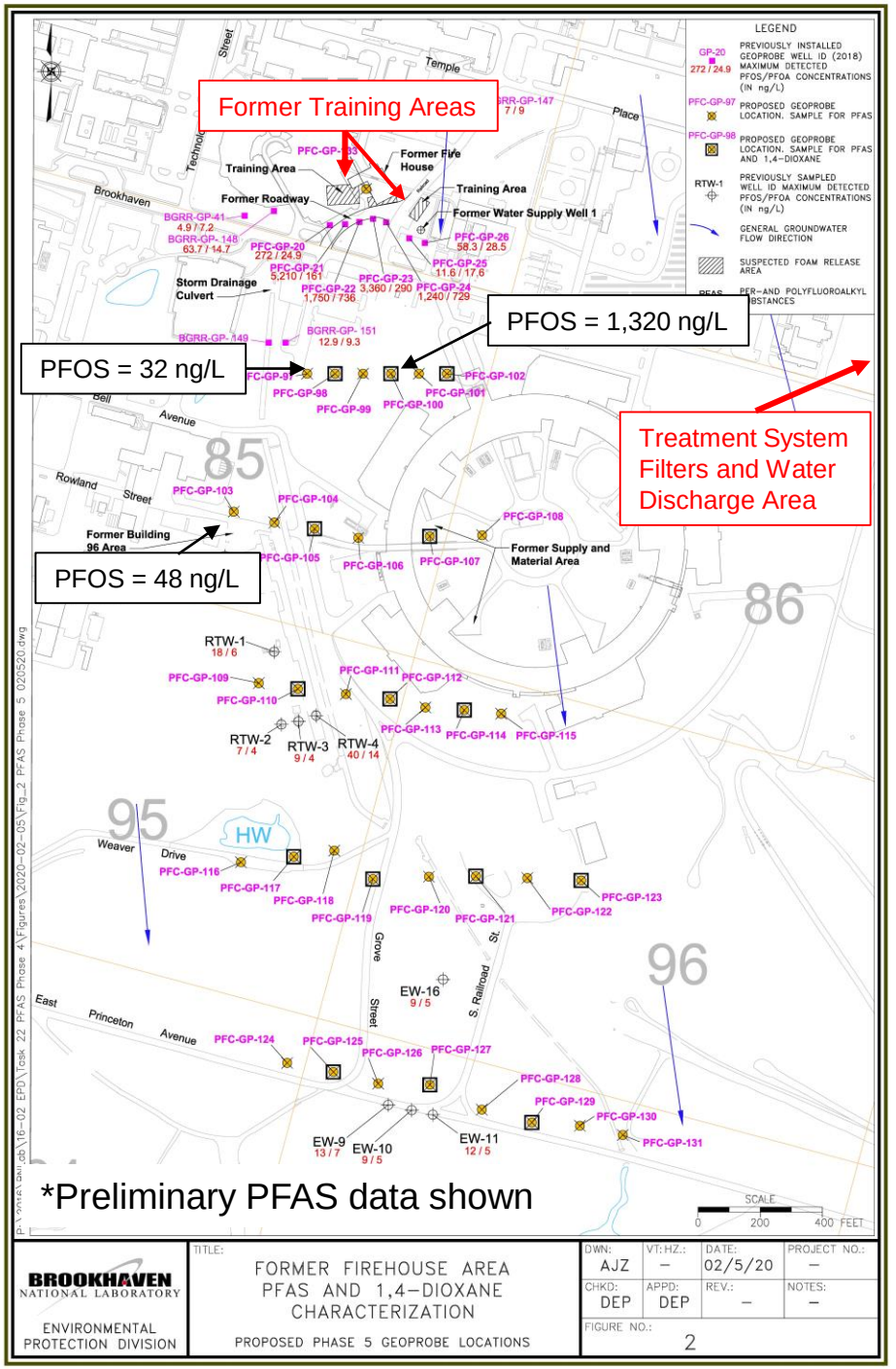
Current Firehouse Plume

- Install up to 42 temporary wells
  - To date, 26 wells have been installed
- Reuse the former BGRR cooling water supply well #105 treatment system filter building. Building was scheduled for demolition
  - In the 1980s-1990s this system was used to treat VOC contaminated groundwater pumped from this well
  - Building is in excellent condition. New carbon filters and piping will be required



Former Firehouse Plume

- Plan to install up to 37 temporary wells
  - To date, 10 wells have been installed
- Will reuse former HFBR pump and recharge system's carbon filters
  - From 1997-2013, this system removed VOCs that were present in the tritium contaminated water
  - Carbon filter vessels are in excellent condition. Minor reconditioning and new piping will be required



Current Understanding

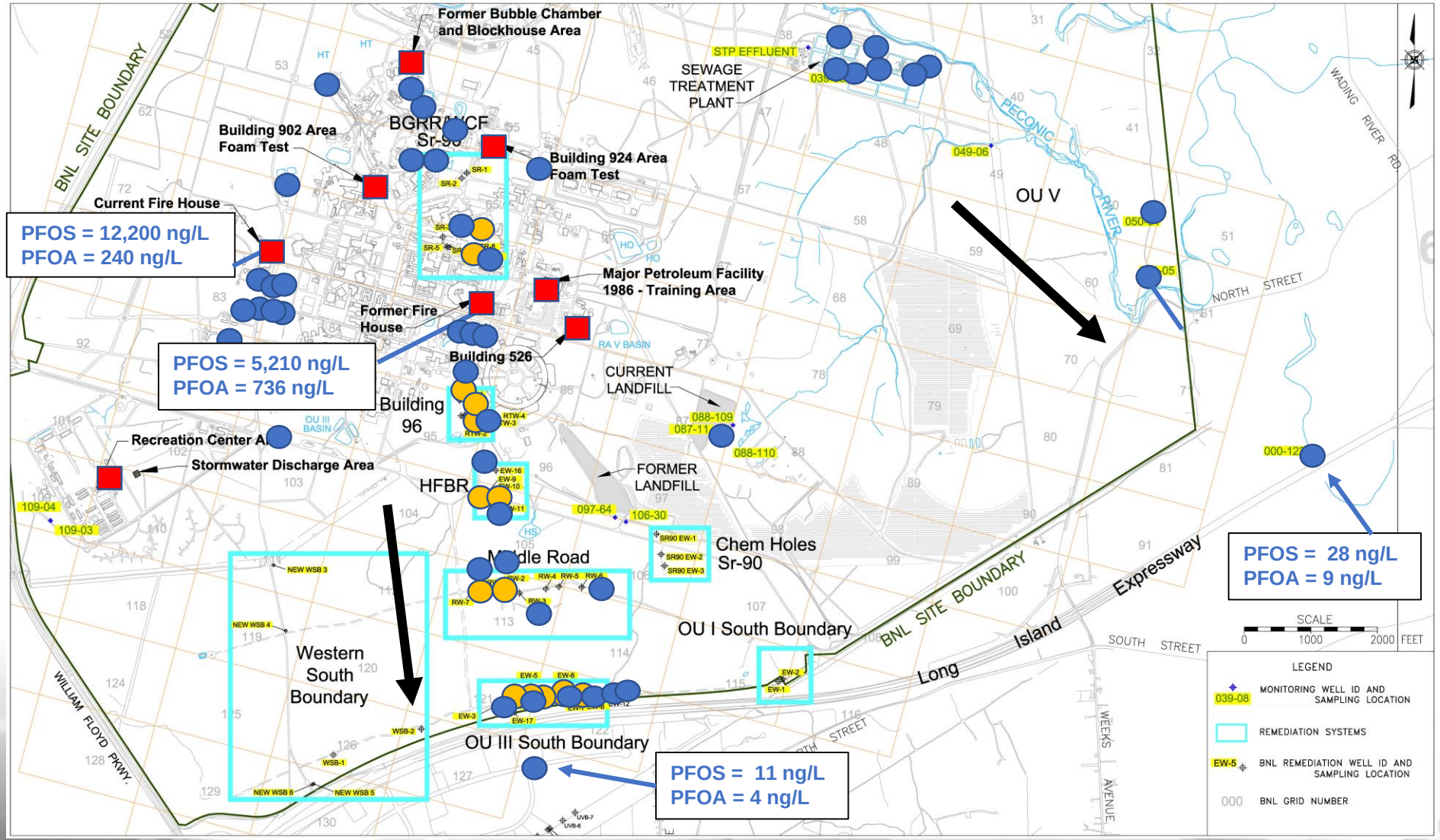
Extent of PFOS or PFOA >10 ng/L

= PFOS and/or PFOA > 10 ng/L (Monitoring Well)

= PFOS and/or PFOA > 10 ng/L (Extraction Well/Treatment System)

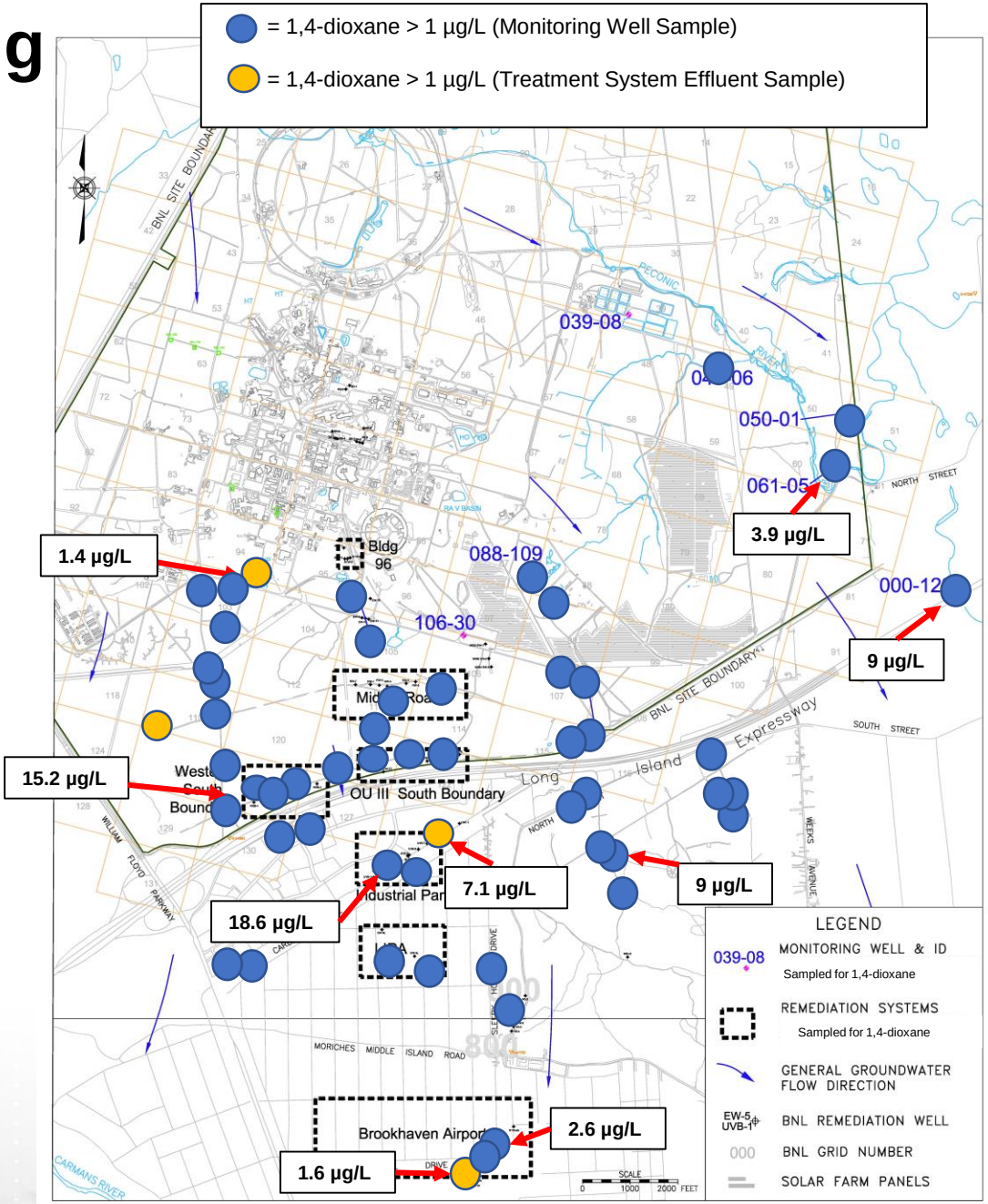
= Foam release area (PFOS and/or PFOA > 10 ng/L)

General Groundwater Flow Direction



Current Understanding

Extent of 1,4-Dioxane >1µg/L



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Testing of Private Supply Wells

- Conducted under a “Technical Services Agreement” with Suffolk County (May 1, 2019 - September 30, 2020)

Process:

- 161 properties were identified by Suffolk County as potentially having private water supply wells
- Suffolk County contacts the property owners
- If property owners agree to participate in the survey, samples are collected by Suffolk County sanitarians
- BNL provides funding for PFAS analyses conducted by BNL’s contract laboratory
- 1,4-Dioxane analyses are conducted by Suffolk County’s analytical laboratory
- County sends the results to the property owners

Private Well Survey Status

74 properties have been sampled:

- **Two properties have two wells, for a total of 76 wells sampled**
- Sampling effort was disrupted by response to Covid-19
- 4 wells were sampled in August & September

Remaining properties:

- 47 have not been sampled
  - No response = 27
  - Declined the offer = 16
  - Scheduled to be sampled = 4
- 32 found to be connected to public water
- 8 were vacant, unoccupied or have no domestic well

Results for the 76 Private Wells

PFOS/PFOA

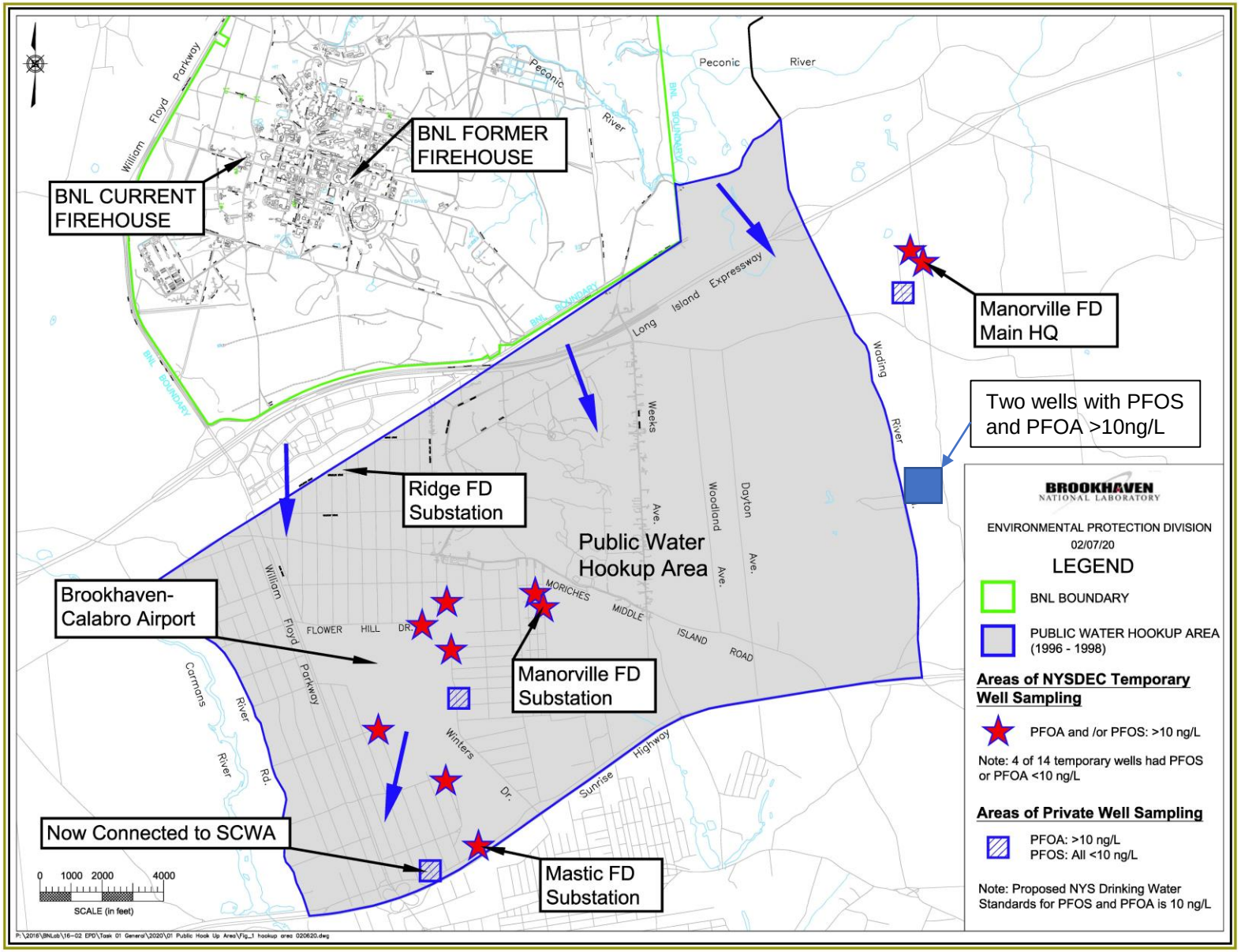
- 3 wells had PFOA >10 ng/L DWS
  - Maximum PFOA concentration was 23 ng/L
  - The three properties are located close to potential PFAS use areas recently examined by New York State Department of Environmental Conservation (Calabro Airport and Manorville FD firehouse)
- 2 wells located at properties on the same street had PFOA and PFOS > 10 ng/L
  - PFOS up to 23 ng/L and PFOA up to 110 ng/L
  - No obvious PFAS use areas are located near these properties
- Results for one well sampled on 9/1/20 are pending

1,4-Dioxane

- No detections of 1,4-Dioxane >1 µg/L DWS
- Low levels of 1,4-Dioxane were detected in 10 of 72 wells; maximum concentration was 0.4 µg/L (detection limit is 0.1 µg/L)
- Results for 4 wells sampled in August and September are pending

Private Well Survey for PFAS and 1,4-dioxane

And 2019 NY State investigation of potential off-site PFAS sources



Summary

BNL has made good progress in characterizing the extent of PFAS and 1,4-Dioxane in groundwater. This work is ongoing

- Continue to work in close coordination with the regulatory agencies
- Required remedial responses will be conducted under the established CERCLA process
- BNL is working to ensure that its potable water will meet the new drinking water standards for PFOS and PFOA